

WHAT IS CLAIMED IS:

1. A thin film magnetic memory device, comprising:
a plurality of magnetic memory cells each having its electric
resistance value varying according to a storage data level written therein
by an applied magnetic field;
5 a first data line electrically coupled to a first voltage through a
selected one of said plurality of magnetic memory cells in data read
operation;
a first precharging circuit for setting said first data line to a
precharge voltage before said data read operation;
10 a first read driving circuit for supplying a data read current to said
first data line in said data read operation;
a first charge transfer feedback amplifier portion provided between
said first data line and a first internal node, for retaining a voltage on said
first data line and producing a first output voltage onto said first internal
15 node according to an integral value of said data read current flowing
through said first data line; and
an amplifier portion for producing read data based on the voltage on
said first internal node.
2. The thin film magnetic memory device according to claim 1,
wherein said precharge voltage is said first voltage, and said first read
driving circuit couples said first data line to a second voltage in said data
read operation.
3. The thin film magnetic memory device according to claim 1,
wherein said first charge transfer feedback amplifier portion includes
5 an operational amplifier for amplifying a voltage difference
between first and second input nodes to produce said first output voltage
onto said first internal node,
a charge transfer portion coupled between said first data line
and said first input node, for transmitting a voltage change on said first

data line due to said data read current to said first input node, and
a charge feedback portion coupled between said first internal
10 node and said first data line, for supplying charges according to a change in
said first output voltage so as to cancel the voltage change on said first data
line from said first voltage, and
said precharge voltage is applied to said second input node.

4. The thin film magnetic memory device according to claim 1,
wherein said plurality of magnetic memory cells are arranged in a matrix,
said thin film magnetic memory device further comprising:
5 a plurality of word lines provided respectively corresponding to
magnetic memory cell rows;
a plurality of bit lines provided respectively corresponding to
magnetic memory cell columns; and
a column selection portion for connecting one of said plurality of bit
lines that is electrically coupled to said selected magnetic memory cell to
10 said first data line.

5. The thin film magnetic memory device according to claim 1,
further comprising:
a dummy memory cell having an intermediate electric resistance
value of two electric resistance values of each magnetic memory cell, said
5 two electric resistance values respectively corresponding to two storage
data levels;
a second data line electrically coupled to said first voltage through
said dummy memory cell in said data read operation;
a second precharging circuit for setting said second data line to said
10 precharge voltage before said data read operation;
a second read driving circuit for supplying a data read current to
said second data line in said data read operation; and
a second charge transfer feedback amplifier portion provided
15 between said second data line and a second internal node, for retaining a
voltage on said second data line and producing a second output voltage onto

said second internal node according to an integral value of said data read current flowing through said second data line, wherein

 said amplifier portion produces said read data according to a voltage difference between said first and second internal nodes.

6. The thin film magnetic memory device according to claim 5, wherein said precharge voltage is said first voltage, and said first and second read driving circuits respectively couple said first and second data lines to a second voltage in said data read operation.

7. The thin film magnetic memory device according to claim 1, further comprising:

 a dummy memory cell having an intermediate electric resistance value of two electric resistance values of each magnetic memory cell, said two electric resistance values respectively corresponding to two storage data levels;

 a second data line electrically coupled to said first voltage through said dummy memory cell in said data read operation;

 a second precharging circuit for setting said second data line to said precharge voltage before said data read operation;

 a second read driving circuit for supplying the data read current to said second data line in said data read operation;

 a second charge transfer feedback amplifier portion provided between said second data line and a second internal node, for maintaining a voltage on said second data line and producing a second output voltage onto said second internal node according to an integral value of said data read current flowing through said second data line; and

 a charge feedback portion coupled between said second internal node and said first data line, for feeding back with a reversed polarity a change in said second output voltage to said first data line.

8. The thin film magnetic memory device according to claim 7, wherein said precharge voltage is said first voltage, and said first and

second read driving circuits respectively couple said first and second data lines to a second voltage in said data read operation.

9. A thin film magnetic memory device, comprising:

a plurality of magnetic memory cells for storing data written by an applied magnetic field, each of said plurality of magnetic memory cells including

5 a magnetic storage portion having one of a first electric resistance value and a second electric resistance value that is larger than said first electric resistance value, according to a level of said storage data, and

10 a memory cell selection gate connected in series with said magnetic storage portion, and rendered conductive when selected;

a first data line electrically coupled to said magnetic storage portion and said conductive memory cell selection gate of a selected magnetic memory cell and receiving a data read current in data read operation;

15 a dummy memory cell having an intermediate electric resistance value of said first and second electric resistance values, said dummy memory cell including

a dummy resistance portion having said first electric resistance value, and

20 a dummy memory cell selection gate connected in series with said dummy resistance portion, and rendered conductive when selected;

a second data line electrically coupled to said dummy resistance portion and said conductive dummy memory cell selection gate and receiving said data read current in said data read operation; and

25 a data read circuit for producing read data based on a voltage change on said first and second data lines, wherein

an electric resistance value of said conductive dummy memory cell selection gate is larger than a third electric resistance value and is smaller than a sum of a difference between said second and first electric resistance values and said third electric resistance value, said third electric resistance value being an electric resistance value of said conductive memory cell

selection gate.

10. The thin film magnetic memory device according to claim 9, wherein each of said memory cell selection gates includes a first field effect transistor, and said dummy memory cell selection gate includes a second field effect transistor having at least one of its gate width and gate length being different from that of said first field effect transistor.

11. The thin film magnetic memory device according to claim 9, wherein

each of said memory cell selection gates includes a first field effect transistor,

5 said dummy memory cell selection gate includes a second field effect transistor having said third electric resistance value when rendered conductive, and a third field effect transistor connected in series with said second field effect transistor and having an electric resistance value smaller than said difference when rendered conductive, and

10 said second field effect transistor is designed in common with said first field effect transistor.

12. The thin film magnetic memory device according to claim 9, wherein said dummy resistance portion includes a magnetic storage portion for storing a data level corresponding to said first electric resistance value, and said magnetic storage portion included in said dummy resistance portion has a same structure as that of said magnetic storage portion included in each magnetic memory cell.

13. A thin film magnetic memory device, comprising:
a plurality of magnetic memory cells for storing data written by an applied magnetic field;

5 a dummy memory cell for comparison with a selected one of said plurality of magnetic memory cells in data read operation, each of said magnetic memory cells and said dummy memory cell including

10 a magnetic storage portion having one of a first electric resistance value and a second electric resistance value that is larger than said first electric resistance value, according to a level of said storage data, and

15 a memory cell selection gate connected in series with said magnetic storage portion, and rendered conductive when selected, said magnetic storage portion included in said dummy memory cell storing data at a level corresponding to said first electric resistance value;

20 a first data line electrically coupled to one of said selected magnetic memory cell and said dummy memory cell in said data read operation;

25 a second data line electrically coupled to the other of said selected magnetic memory cell and said dummy memory cell in said data read operation;

30 a data read circuit for supplying a data read current to each of said first and second data lines and producing read data based on a voltage change on said first and second data lines in said data read operation; and

35 a dummy resistance adding circuit for selectively connecting a resistance portion in series with one of said first and second data lines that is electrically coupled to said dummy memory cell, said resistance portion having an electric resistance value smaller than a difference between said first and second electric resistance values.

14. The thin film magnetic memory device according to claim 13, wherein said resistance portion includes a field effect transistor receiving a variable control voltage at its gate.

15. The thin film magnetic memory device according to claim 13, wherein said dummy resistance adding circuit selects one of said first and second data lines to which said resistance portion is connected, according to a part of a row address.